



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification⁶ :

H04B 13/00, G08C 17/00

A1

(11) International Publication Number:

WO 96/23373

(43) International Publication Date:

1 August 1996 (01.08.96)

(21) International Application Number: PCT/GB96/00167

(22) International Filing Date: 25 January 1996 (25.01.96)

(30) Priority Data:

9501408.0	25 January 1995 (25.01.95)	GB
9506448.1	29 March 1995 (29.03.95)	GB
9522535.5	3 November 1995 (03.11.95)	GB

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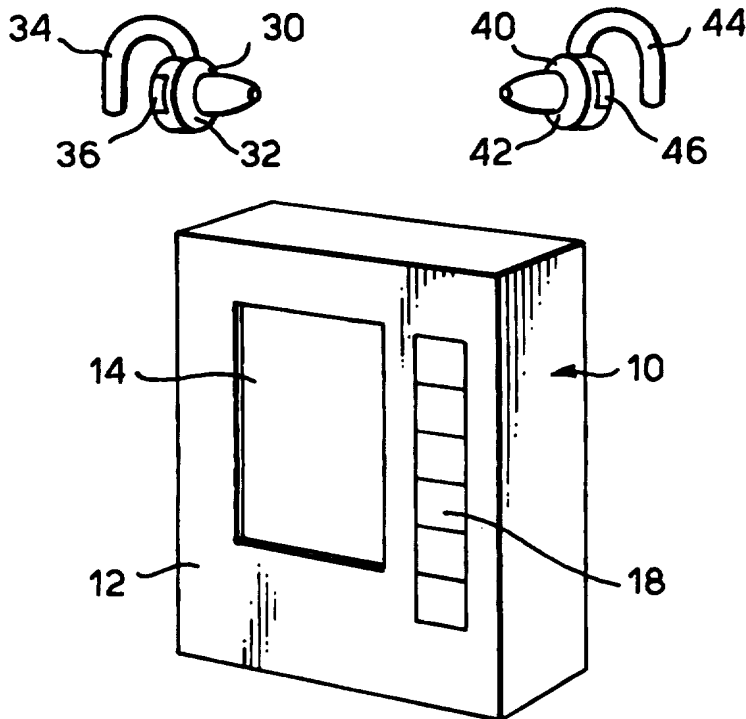
(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AZ, BY, KG, KZ, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published*With international search report.**Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.*

(54) Title: COMMUNICATION METHOD

(57) Abstract

Audio apparatus comprises a base unit including circuitry for generating electrical signals representing sounds and at least one earphone adapted to receive the electrical signals and to reproduce sounds represented by the signals, in which the apparatus is provided externally with a terminal arranged so that it can be positioned in use in contact with or in close proximity to the surface of the user's body, the circuitry is arranged to supply to the terminal signals which are transmitted through the user's body, the or each earphone is provided with a terminal arranged so that it can be positioned in use in contact with or in close proximity to the surface of the user's body so as to receive signals transmitted from the terminal through the user's body, and the or each earphone includes receiving circuitry arranged to receive the signals. The earphones may be embodied in a pair of spectacles, and may be adjustable between a first position behind the ear and a second position in or more adjacent the ear.



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Communication Method

5 This invention relates to a method of radio frequency communication, in particular, but not exclusively, in audio apparatus of the kind consisting of a base unit containing circuitry for generating electrical signals representing sounds and at least one earphone adapted to receive the electrical signals and to reproduce sounds represented by the signals. By earphone, we mean an electroacoustic transducer adapted to fit in or adjacent the ear to provide sound thereto, preferably without significant emission of sound to the environment.

10 The invention relates particularly, but not exclusively, to portable audio apparatus of the kind often called "personal stereo" equipment, in which the base unit contains sound reproducing apparatus such as an audio cassette player, compact disc player, and/or a radio receiver. In such apparatus, the circuitry in the base unit is designed to generate audio frequency signals which are supplied to the earphones through flexible leads extending from the base unit to the earphones.

15 The earphone leads of known personal stereos are unsightly and can be disadvantageous, for example if the user wishes to take part in physical exercise whilst wearing the apparatus.

It is an object of this invention to provide portable audio apparatus which avoids this disadvantage.

20 According to the first aspect of the present invention there is provided a method of radio frequency communication between a transmitter and a receiver comprising disposing antenna means of the transmitter and the receiver sufficiently adjacent the body of a user for radio frequency signals to be transmitted substantially solely through the user's body from the transmitter to the receiver.

According to a second aspect of the present invention there is provided apparatus comprising a first portion and second portion physically separate therefrom, at least one of the portions being adapted to transmit radio frequency signals, at least the other portion being adapted to receive radio frequency signals, one said portion being
5 carried by or worn on or about the body of a user of the apparatus, and having means to transmit radio frequency signals thereto at least an antenna or terminal of the other portion being disposable in contact with or adjacent the user's body so that radio frequency communication between said portion is established through the user's body.

Thus the apparatus may be audio apparatus, wherein one portion is a base unit for
10 generating radio frequency electrical signals representing sounds and the other portion comprises an earphone and means for demodulating the radio frequency signals into audio signals to drive the earphone.

The terminal is preferably a coil. This is particularly advantageous where the terminal is located adjacent to the user's body.

According to a third aspect of the present invention there is provided audio apparatus comprising a base unit including circuitry for generating electrical signals representing sounds and at least one earphone adapted to receive the electrical signals and to reproduce sounds represented by the signals, in which the apparatus is provided
15 externally with a first terminal arranged so that it can be positioned in use in contact with or in close proximity to the surface of the user's body, the circuitry is arranged to supply to the first terminal signals which are transmitted through the user's body,
20 the or each earphone is provided with a further terminal arranged so that it can be positioned in use in contact with or in close proximity to the surface of the user's body so as to receive signals transmitted from the first terminal through the user's
25 body, and the or each earphone includes receiving circuitry arranged to receive the signals.

The first terminal may be provided on a housing of the base unit.

The apparatus of this invention avoids the use of leads extending between the base unit and the earphones.

Preferably, the or each earphone includes an energy storage device (eg. a capacitor or battery) or an energy producing device (eg. a solar cell) to power the earphone circuitry, and a switch to turn off the circuit or switch it to a quiescent state when the earphone is not in use, to prevent power drain. The switch may be automatically operated by insertion of the earphone into the user's ear, for example in response to flexing of a part of the earphone used to hold the earphone in position, or in response to detection of the contact of the earphone terminal with the user's skin. Alternatively or additionally, the switch may be operated in response to the detection of the presence at the earphone terminal of an electrical signal at the appropriate carrier frequency at which the base unit transmits the signal. The base unit may include means for recharging the energy storage device. Preferably, there are means for stowing the or each earphone when not in use; said stowing means may include electrical connectors for connecting the power storage device to the recharging means.

In some circumstances, where the electrical signals received by the earphone are strong enough to power the receiving circuitry and transducer, it may be possible to dispense with the use of a battery or storage capacitor in the earphone.

The invention may be applied to personal stereo apparatus. In accordance with a preferred aspect of this invention, the apparatus includes left and right earphones, and the circuitry in the base unit is arranged to transmit left and right stereo signals suitably encoded for reception by the left and right earphones. The left and right stereo signals may for example be transmitted at different carrier frequencies.

The base unit may include a tape cassette player, CD player, radio or other sound source in the same way as the base unit of a conventional personal stereo.

Alternatively, the apparatus of this invention may be adapted for connection to a conventional personal stereo apparatus or other source of signals, so that it can be

converted to a cordless system. In this case, the base unit of the apparatus of the invention need only contain circuitry to convert the output signals of the conventional apparatus to a form suitable for transmission through the housing terminal of the unit. For example, the unit may be provided with a lead arranged to be plugged into an earphone socket of the personal stereo or other apparatus, to receive the audio frequency output signals of the personal stereo. In one embodiment, the output signals are sufficient to power the unit without the need for a separate battery in the unit.

The base unit of the apparatus of this invention may comprise a mounting or container for containing or supporting the signal source apparatus.

The circuitry of the or each earphone may be arranged to transmit electrical signals through the earphone terminal, to be received by suitable circuitry in the base unit. This may be used as a control unit, for example in the personal stereo embodiment of the invention to facilitate volume control on the base unit, or to CD track or radio station selection.

In another form of the invention, the electrical signals transmitted by the earphone may be derived from a microphone contained in or connected to the casing of the earphone and arranged to detect the user's speech. The apparatus of the invention may then be used as part of a telephone or other communication system, the base unit being connected by suitable means to a telephone network. For example, the apparatus of the invention could be used to provide an improved hands-free mobile phone unit or car phone.

The invention could also find application in other situations where conventional apparatus uses earphones or headphones connected by flexible leads to a base unit, or which use radio transmission between the base unit and the earphones, such as telephone switchboard systems, mobile speech recording and communication systems, television studio microphone and earphone communication units, conference systems and aircraft and other transport entertainment or communication systems.

Thus the base unit may be for installation in a vehicle, means being provided to connect the base unit to the vehicle whereby part thereof in contact with or proximate the user's body forms said terminal. In a motor vehicle, the steering wheel, the seats, or even the floor provide potentially suitable structures for use as the terminal.

5 A fourth aspect of the invention is directed to the problems associated with known earphones. These problems include for example that earphones located on a headband are bulky to store and to carry when not in use and, in use, may disturb the hair of the wearer. Earphones of the type attached to separate leads may feel insecure to the
10 wearer and are readily pulled out of the ear if the lead is caught, for example in the user's clothing or bag.

A further problem with either arrangement is that the earphones may be awkward and uncomfortable to wear if the user wears any form of glasses, including prescription
15 glasses to correct any sight defects, sunglasses, safety glasses, sports goggles or visors, etc. For ease of reference, the various types of glasses or other eyewear will be referred to simply as spectacles throughout the following description of the invention.

These and other problems have been overcome in this aspect of the present invention by providing spectacles which have an earphone located at the ear end of at least one
20 arm of the spectacles; the spectacles being adapted such that they may be worn in the conventional manner with the ear ends of the arms located behind the ears or they may be worn with the earphone located in or adjacent to the ear.

Thus, in this aspect of the present invention there is provided a pair of spectacles comprising a frame for holding lenses and an arm extending from each side of the frame, the arms having a frame end and an ear end; wherein the ear end of at least
25 one arm includes an earphone and wherein the spectacles include adjusting means for adjusting the ear end from a first position in which, when the spectacles are worn such that the frame rests on the bridge of the nose, the earphone is located behind the ear to a second position in which, when the spectacles are worn such that the frame

rests on the bridge of the nose, the earphone is located in or adjacent to the ear. Both of said arms preferably include an earphone at their respective ear ends and means for adjusting the ear end from a first position to a second position.

- 5 The spectacles of this aspect of the present invention may be adapted for use with conventional audio apparatus or may be for use with audio apparatus according to the first aspect of the invention or integral sound source.

10 Thus, the spectacles may additionally comprise a terminal arranged so that it can be positioned in use in contact with or in close proximity to the user's body so as to receive signals transmitted from the housing terminal through the user's body, and the or each earphone includes receiving circuitry arranged to receive the signals from the base unit.

The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

- 15 Figure 1 is a diagrammatic illustration of personal stereo apparatus in accordance with the invention;

Figure 2 is a rear view of a base unit of the apparatus of Figure 1;

Figures 3 and 4 show further embodiments of the invention;

Figure 5 is a side elevation of spectacles according to the invention;

- 20 Figure 6 is a fragmentary view of part of an arm and earphone of the spectacles, viewed from "A" in Figure 5;

Figure 7 is a fragmentary elevation of the spectacles of Figure 5 showing an arm in the extended position;

Figure 8 is a fragmentary plan view of the spectacles of Figure 5;

Figure 9 is an enlarged cross-sectional view of an earphone of the spectacles;

Figure 10 is a diagrammatical illustration of some of the various positions in which the spectacles may be worn;

5 Figure 11 is a side elevation of spectacles according to a further embodiment of the present invention;

Figure 12 is a fragmentary view of part of an arm and earphone of the spectacles, viewed from "A" in Figure 11;

10 Figure 13 is a fragmentary view of part of an arm and earphone of the spectacles, viewed from "B" in Figure 12;

Figure 14 and 15 show a side elevation of spectacles according to a further embodiment of the present invention.

Figure 16 is a plan view from above of a preferred embodiment of the invention.

15 Figures 17A and 17B are side elevations of spectacles according to a still further embodiment of the present invention.

Figure 18 is a fragmentary view of part of an arm and earphone of the spectacles.

Figures 19 and 20 show a further embodiment of the invention; and

Figures 21 and 22 each show additional embodiments of the invention.

20 Referring to Figures 1 and 2, a personal stereo apparatus consists of a base unit 10 and left and right earphones 30 and 40.

The base unit 10 consists of a housing 12 containing sound reproducing apparatus such as a tape cassette player, CD player and/or radio receiver 14, or sound producing apparatus a battery compartment 16 and controls 18 for the radio/cassette player 14. A clip 20 fixed to the rear face 22 of the housing 12 enables the housing to be attached to the user's clothing, for example to a belt. The base unit 10 thus far is the same as the base unit of a conventional personal stereo. However, instead of flexible leads connecting it to the earphones 30 and 40, the base unit 10 has an output terminal 24 attached to the outer face of the clip 20. The terminal is positioned so that when the base unit 10 is attached to the user's clothing by the clip 20 the terminal 24 is in contact with, or in close proximity to, the user's body.

The circuitry of the radio/CD/cassette player is arranged to supply to the terminal 24 electrical signals at carrier frequencies which allow the signals to be transmitted through the user's body. Two signals at different carrier frequencies are used, to carry left and right stereo signals to the earphones 30 and 40. The carrier frequencies may be, for example, 2.5 MHz and 3.0 MHz.

Alternatively, other ways of encoding the left and right signals could be used.

Any suitable arrangement for the earphone may be used. In one particularly preferred arrangement the earphone 30 has a casing 32 shaped so that it can fit into the user's ear, and is provided with a spring arm 34 to hold the earphone in position. The shapes of the earphone and clip may be similar to those of a conventional earphone. The earphone 30 includes a terminal 36 fixed to the casing 32 or spring arm 34, so that when the earphone is worn the terminal 36 is in contact with or in close proximity to the user's skin.

The earphone 30 includes receiving circuitry adapted to receive the signals transmitted by the base unit 10 and picked up by the terminal 36, and to drive a transducer in the casing 32, so as to generate sound corresponding to the left channel signal transmitted by the base unit. The casing 32 also houses a suitable battery to power the circuitry.

The right earphone 40 is constructed in the same way as the left earphone 30, having a casing 42 with a spring arm 44 and terminal 46. The receiving circuitry of the right earphone 40 is arranged to drive a transducer in the casing 42 to generate sound corresponding to the right channel signal transmitted by the base unit 10.

5 It will be appreciated that modifications may be made in the described embodiment. For example, instead of providing a separate terminal on the earphones, the casing of each earphone could be made of an electrically conductive plastics material, and the casing itself used as the earphone terminal.

10 As illustrated in Figure 3, cavities 50 may be provided in the base unit 10 in which earphones 52 may be stowed when not in use. The cavities correspond to the shape of the earphones, and may be provided with contacts 54,56 which connect with corresponding contacts 58,60 on the earphones. By this means, when the earphones are stowed, their internal batteries may be charged from the battery contained in the base unit. One of the contacts 58,60 may double as the terminal 36 already
15 described.

The terminal on the base unit could take different forms. For example, the terminal could be provided on a flexible strap attached at one end to the housing and arranged so that it can be tucked into the user's clothes to make contact with the skin. Alternatively, the housing could be made of conductive plastics material and used
20 itself as the terminal.

Figure 4 shows a further form of the base unit, this time in the form of an adapter for modifying an existing personal stereo apparatus. The adapter 62 comprises a connector (eg. a jack) 64 to fit the earphone socket 66 of a conventional personal stereo apparatus 68. The adapter thereby receives the audio output of the personal
25 stereo.

The adapter may be situated in a wall of a pouch or pocket 70 (shown partially cut-away) attached to a belt 72 to be worn by the user. At least part of the inwardly-

facing surface of the belt is conductive, such that a terminal equivalent to terminal 24 of Figure 1 for transmitting signals into the user's body is formed. In use, the personal stereo is placed in the pocket 70 and connected to the adapter 62. The audio output is processed as previously described in the context of Figures 1 and 2 and transmitted through the user's body to the earphones.

The adapter 62 may be provided with storage cavities as in Figure 3, in which case power for the adapter is provided by an internal battery. It will be appreciated that the pouch or pocket 7 can equally be provided as part of a rucksack, handbag or shoulder bag, the handle or strap in each case containing the transmitting terminal. Indeed, the pouch or pocket can be embodied in clothing or a fashion or sports accessory which is worn or carried.

The earphones could be provided in other forms, for example in any of the styles in which conventional earphones are provided. The earphones could be incorporated into the arms of a pair of spectacles. Instead of providing batteries for the earphones, they could be powered by solar cells. For example, if the earphones are connected to a structure, as in a conventional headset, on the frame of a pair of spectacles, a single array of solar cells could be mounted in a suitable position on the structure and connected by wiring to the earphones.

The spectacles according to the above first aspect will now be described with reference to Figures 5 or 9. The spectacles preferably comprise lenses 101 located within a frame 102. An arm 103 extends from each side of the frame 102. The arm is preferably of the conventional shape and therefore has a curved portion 104 adapted to be placed behind the ear to allow the spectacles to be worn in a conventional manner, i.e with the frame resting on the bridge of the wearer's nose and the ear end of the arm being located behind the wearer's ear. Located at the ear end of the arm is an earphone 105 which is located in a recess 106 in the arm 104. The recess 106 may, in one alternative arrangement, be located on the outer surface of the ear end of the arm. In another alternative arrangement the earphone is located on a pin at the end of the arm.

As can be seen from Figure 8, the arms may be attached to the frame by means of a hinge 10 such that the spectacles may be folded for storage in the conventional manner.

5 The spectacles have adjusting means which enable the ear end of the arms of the spectacles to be moved from the conventional position in which the ear end, and thus the earphone, is located behind the ear to a listening position in which the ear end of the arm is located across the ear and the earphone is located in, or adjacent to, the ear.

10 The arms of the spectacles may be formed such that they have some inherent elasticity to facilitate movement of the arms from the conventional position to the listening position.

15 In the embodiments illustrated in Figures 5 or 9, the adjusting means comprises means by which each of the arms is adjustable in length. As shown in Figure 7, one arrangement of the adjusting means is where the arm is divided into two portions, 103a and 103b. A pin 107 fixed to the front portion 103a is slidable in a bore 108 in the rear portion 103b. The pin and the co-operating bore are preferably curved upwardly such that when the arm is in the position shown in Figure 7, ie. in the extended position, the recess 104 will sit comfortably behind the ear of the wearer and when the rear portion is moved forwardly along the pin such that portion 103b abuts portion 103a, the ear end of the arm is located across the ear and the earphone is located adjacent to, or in, the ear. Thus, as the rear portion of the arm is moved towards the front portion, the inclination of the rear portion changes.

20 In a particularly preferred embodiment the arms are configured such that as they move from the contracted position to the extended position the ear end of the arm transcribes an upwardly extending arc as illustrated in Figure 14.

Whatever configuration is used for the arms of the spectacles, the movement from the contracted to the expanded position may be sprung loaded. In this arrangement a

release catch 901 may extend from the arm, which when depressed releases the spring 902 which causes the arm to move to its extended configuration. The spring mechanism is illustrated in Figure 15 with reference to the arm arrangement of Figure 14. It will be understood that the spring loaded arrangement may be incorporated
5 into other possible configurations for the arms.

Whatever or not the arms are sprung loaded, a projection may extend from the ear end of the arms such that movement of the arm from the extended to the contracted position could readily be achieved by the user holding the projection with, for example, the thumb and whilst holding the frame in his fingers moving the thumb
10 towards the fingers.

In an alternative embodiment illustrated in Figures 11 to 13, the arm is formed from two parts, a first part 103c and a second part 103d. The first and second parts are connected together by means of a pin 112 such that the second part is rotatable about the pin. The ear end of the arm may then be adjusted from a first position in which the first and second parts are collinear and in which the ear end of the arm sits comfortably behind the ear of the wearer to a second position in which the second
15 part is angled from the first part and in which the ear end of the arm is located across the ear and the earphone is located in, or adjacent to, the ear by pivoting the second part 103d about the pin 112.

In a preferred embodiment illustrated in Figure 17, the first 171a and second 171b parts are connected by a pin (not shown) extending from the second part which is slidable in a channel 172 in the first part. The channel is preferably curved upwardly at the end remote from the frame of the spectacles. The movement from the contracted position (Figure 17B) to the extended position (Figure 17A) is preferably
20 sprung loaded. A release catch may be located in any convenient position.
25

If the earphone is to be located in the ear it is preferably pivotable from a position in which it is coplanar with the arm, for example extending from the end of the arm or located in a recess 106 to a position in which it is angled to the arm. The

earphone is preferably angled at 90° to the arm. As shown in Figure 9, the earphone may be mounted on a pin 109 pivotable at a point 113 to the arm. The earphone is also rotatable about the axis of the pin, so that the spectacles may be worn in a variety of positions on the head with the earphones remaining in the correct orientation within the ear. A selection of suitable positions together with some positions in which the spectacles are being worn in the conventional manner are illustrated in Figure 10. Thus, the spectacles may be worn on the nose or on the head with the ear end of the arm located behind the ear or, they may be worn on the nose, on the head, behind the head or even under the chin with the earphones located in, or adjacent to, the ear. The arms of the spectacles are preferably curved in a convex manner to accommodate the wearer's head as illustrated in Figure 16. This enables the spectacles to be readily moved between the positions. The spectacles may be adapted such that the rotation of the earphone from the storage position in the manner described acts as a switch to activate the earphones.

As illustrated in Figure 18, the earphone may be sprung loaded such that on release of a catch the earphones move to the listening position. Upon release of the catch the earphones preferably also rotate about the pin 109 to the vertical position.

Additionally or alternatively, the action of moving the arm from the expanded to the contracted position, may release the earpieces to the listening position.

The arms of the spectacles may contain suitable electrical circuitry to convert an electrical signal received from one or two leads (not shown) from a base unit (not shown) to an audio signal. Where the electrical signal is received from one lead, the spectacles will include integral wires connecting the earphones to the lead. The signal may be introduced into the spectacles by means of one or two suitable socket(s).

When the base unit is of the kind described with reference to the first to third embodiments of the present invention the spectacles additionally comprise one or two terminal(s) 114 arranged so that they can be positioned in use in contact with, or in close proximity to, the user's body so as to receive signals transmitted from the

housing terminal through the user's body, and the or each earphone includes receiving circuitry arranged to receive the signals from the base unit. The terminal may therefore advantageously be located on the inner surface of the ear end of the arm. Where the spectacles include one terminal, the spectacles will include integral wires
5 connecting the earphones to the terminal.

Additionally or alternatively, the spectacles may include integral audio apparatus, such as, for example, a radio receiver or other sound source, including a solid state sound source. In this case, the spectacles will also include appropriate circuitry to convert the signals to audio signals and transmit them to the earphones.

10 The spectacles may alternatively be adapted to receive any other method of providing signals to the earphones, for example signals transmitted in the infra-red portion of the electromagnetic spectrum.

The spectacles of the present invention may be modified in a variety of ways. For example, the spectacles may incorporate controls and/or switches to enable the user
15 to control the volume level of the sound. Other parameters may also be controlled.

Means may be incorporated between the arms of the spectacles and the earphones to reduce acoustic noise. In one preferred embodiment the means are mounts formed from a resilient material such as rubber.

20 The spectacles have been described with reference to their proposed use with portable audio apparatus. However, it will be appreciated that the spectacles would be advantageous in a variety of fields. For example, if a microphone is incorporated in the spectacles, for example, at the base of the lenses, the spectacles would be useful as part of a hands-free telephone, or as any type of communication device, such as may be used in television studios or in security operations.

The spectacles of the present invention are also suitable for use as a hearing aid device, particularly a directionally sensitive hearing aid device. Such a system would be particularly advantageous to a person who has difficulty with background noise.

5 If a power source, for example a solar cell or battery is incorporated in the spectacles, this could be utilised to enable the wearer to control the darkness of the lenses. In this case, the lenses would include a liquid crystal or other means of achieving a darkening of the lens. This power could also be used to generate a head up display on the interior of the lenses which could operate in conjunction with the signal transmitted from the base unit. Similarly, the lenses may include displays for
10 games or other purposes.

Figures 19 and 20 illustrate a mobile telephone which makes use of the invention to provide a safe hands-free mode of operation for in-car use.

The mobile telephone 72 is provided with a connector 74 on its bottom edge which is received by a complementary connector 75 in a storage device or base unit 76
15 which is mounted in the vehicle convenient to the driver. In addition to the conventional connections 78,80 to the car electrical system and to a transmit/receive antenna, the base unit also contains an adaptor 81 similar to 62 of Figure 4. This is connected to an antenna or terminal 82 in the driver's seat. The earphone and microphone circuits of the telephone 72 are connected via the connectors 74, 75
20 to the base unit 76. An earphone 84 similar to that of Figure 3 with a microphone 86 attached, receives and transmits signals from and to the base unit via the driver's body and the seat antenna 82. The driver may thus conduct a safe hands-free conversation whilst driving. The telephone is provided with a storage means 88 as in Figure 3 to house the earphone/microphone headset 84,86 when not in use and to
25 recharge it.

The mobile telephone of this embodiment has the advantage that background noise and feedback are reduced.

As an alternative to providing the signal conversion circuitry in the base unit 76, it can be provided in the telephone 72 itself. Then the base unit 76 need be only a simple connector and furthermore the casing of the telephone 72 can be provided with an additional antenna or terminal similar to 24 of Figure 1 so that the headset
5 84, 86 can be used with the telephone in the user's pocket, or merely carried rather than held to the head. Locating the headset in these positions overcomes any problems associated with locating a transmitter adjacent to the head.

Referring to Figure 21, a wristwatch provides a particularly convenient means of implementing the invention, because good contact can be achieved with the wearer's
10 body via an antenna or terminal on the inside of the strap or the back of the case.

Thus a wristwatch has a case 88 with a display 89, preferably an LCD display, (normally showing the time) and keypad 90 on the front, and a body-contact terminal or antenna on the back. A removable earphone 91 similar to that of Figure 3 may be stowed in the body of the watch, together with a microphone 92. As illustrated
15 the wristwatch is configured as a mobile telephone or radio system, eg. for use within a building, but equally or in addition, can embody a broadcast radio receiver or other small sized sound source.

If greater battery power is required, the batteries and the power-consuming circuits
20 can be provided in a separate unit 94 as shown in Figure 22, only the controls being provided in the wristwatch.. Then through-body communication is provided between all three parts of the system 88,91,94 by employing three or more carrier frequencies so that any two of the units can communicate without interference from the other, as illustrated diagrammatically by arrow, 95,96,97.

The watch may have data input and/or storage facilities. Data may be readily
25 transferred from the watch to a computer having as an integral part, or as an accessory, a terminal that enables contact to the body. Data can then be transferred without removing the watch from the wrist and without cables and connectors.

Each feature disclosed in this specification (which term includes the claims) and/or shown in the drawings may be incorporated in the invention independently of other disclosed and/or illustrated features.

The appended abstract as filed herewith is included in the specification by reference.

CLAIMS:

1. A method of radio frequency communication between a transmitter and a receiver comprising disposing antenna means of the transmitter and the receiver sufficiently adjacent the body of a user for radio frequency signals to be transmitted substantially solely through the user's body from the transmitter to the receiver.

2. Apparatus comprising a first portion and second portion physically separate therefrom, at least one of the portions being adapted to transmit radio frequency signals, at least the other portion being adapted to receive radio frequency signals, one said portion being carried by or worn on or about the body of a user of the apparatus, and having means to transmit radio frequency signals thereto, at least an antenna or terminal of the other portion being disposable in contact with or adjacent the user's body so that radio frequency communication between said portions is established through the user's body.

3. Apparatus as claimed in Claim 2, being audio apparatus wherein one portion is a base unit for generating radio frequency electrical signals representing sounds and the other portion comprises an earphone and means for demodulating the radio frequency signals into audio signals to drive the earphone.

4. Audio apparatus comprising a base unit including circuitry for generating electrical signals representing sounds and at least one earphone adapted to receive the electrical signals and to reproduce sounds represented by the signals, in which the apparatus is provided externally with a first terminal arranged so that it can be positioned in use in contact with or in close proximity to the surface of the user's body, the circuitry is arranged to supply to the first terminal signals which are transmitted through the user's body, the or each earphone is provided with a further terminal arranged so that it can be positioned in use in contact with or in close proximity to the user's body so as to receive signals transmitted from the first terminal through the user's body, and the or each earphone includes receiving circuitry arranged to receive the signals.

5. Apparatus as claimed in claim 4, wherein the first terminal is provided on a housing of the base unit.

5 6. Audio apparatus as claimed in claim 4 or claim 5, which includes left and right earphones, and in which the circuitry in the base unit is arranged to transmit left and right stereo signals suitably encoded for reception by the left and right earphones.

7. Audio apparatus as claimed in any of claims 3 to 6, in which the or each earphone includes a power storage or producing device to power the earphone circuitry.

10 8. Audio apparatus as claimed in claim 7, wherein the power storage device comprises a battery or a capacitor.

9. Audio apparatus as claimed in claim 7, wherein the power producing device comprises a solar cell.

10. Audio apparatus as claimed in claim 7 or 8, wherein the base unit comprises means for recharging the power storage device.

15 11. Audio apparatus as claimed in claim 10, wherein the base unit comprises means for stowing the or each earphone when not in use, said stowing means including electrical connectors for connecting the power storage device to the recharging means.

20 12. Audio apparatus as claimed in any of claims 3 to 11, in which the or each earphone has a casing of electrically conductive material which also acts as the earphone terminal.

13. Audio apparatus as claimed in claim 2 or any claim dependent therefrom, in which the housing includes a clip for releasably attaching the base unit to the user's clothing, and the housing terminal is fixed to or formed by the clip.

14. Audio apparatus as claimed in any of claims 3 to 13, in which the base unit is adapted to be attached to the base unit of an existing personal stereo apparatus or other apparatus being a source of signals, the circuitry of the base unit of the audio apparatus being adapted to receive signals from the circuitry of the signal source apparatus.

15. Audio apparatus as claimed in claim 14, in which the base unit of the portable audio apparatus is arranged to receive audio frequency signals from an earphone socket of the base unit of the signal source apparatus.

16. Audio apparatus as claimed in claim 14 or 15, wherein the base unit comprises a mounting or container for supporting the signal source apparatus.

17. Audio apparatus as claimed in any of claims 3 to 16, in which the circuitry of the or each earphone is arranged to transmit electrical signals through the earphone terminal, to be received by suitable circuitry in the base unit.

18. Audio apparatus as claimed in claim 17, in which the electrical signals transmitted by the earphone are derived from a microphone contained in or connected to the casing of the earphone and arranged to detect the user's speech.

19. Audio apparatus as claimed in claim 4, wherein the base unit is for installation in a vehicle, means being provided to connect the base unit to the vehicle whereby part thereof in contact with or proximate the user's body forms said first terminal.

20. Audio apparatus as claimed in claims 18 and 19, wherein the base unit is a mobile telephone.

21. A pair of spectacles comprising a frame for holding lenses and an arm extending from each side of the frame, the arms having a frame end and an ear end; wherein the ear end of at least one arm includes an earphone and wherein the spectacles include adjusting means for adjusting the ear end from a first position in

which, when the spectacles are worn with the frame resting on the bridge of the nose, the earphone is located behind the ear to a second position in which, when the spectacles are worn with the frame resting on the bridge of the nose, the earphone is located in or adjacent to the ear.

5 22. A pair of spectacles as claimed in claim 21, wherein both of said arms include an earphone at their respective ear ends and means for adjusting the ear end from a first position to a second position.

23. A pair of spectacles as claimed in claim 21 or 22, wherein the adjusting means comprises means by which the or each of the arms is adjustable in length.

10 24. A pair of spectacles as claimed in claim 23, wherein the or each arm is divided into two portions and wherein a pin fixed to the one of said portions is slidable in a bore in the other of said portions.

15 25. A pair of spectacles as claimed in claim 24, wherein the pin and the co-operating bore are curved upwardly such that when the arm is extended the ear end of the arm will sit comfortably above and/or behind the ear of the wearer and when the arm is contracted the ear end of the arm is located across the ear and the earphone is located adjacent to or in the ear.

20 26. A pair of spectacles as claimed in claim 21 or 22, wherein the adjusting means is provided by means of the at least one arm being formed from two parts which are connected together by a pin about which one part pivots with respect to the other such that the ear end of the arm may be adjusted from a first position in which it sits comfortably above and/or behind the ear of the wearer to a second position in which the ear end of the arm is located across the ear and the earphone is located in or adjacent to the ear.

25 27. A pair of spectacles as claimed in any of claims 21 to 26 additionally including means for attaching leads extending from the base unit of audio apparatus.

28. A pair of spectacles as claimed in any one of claims 21 to 26 additionally including an integral sound source.
29. A pair of spectacles as claimed in any of claims 21 to 26 additionally including a terminal arranged to be in contact with or in close proximity to the user's body and receiving circuitry arranged to receive the signals generated by a base unit and transmitted to the earphones from a terminal located on the housing of the base unit of audio apparatus through the user's body
30. Audio apparatus as claimed in claim 3 or claim 4, wherein the at least one earphone forms part of a pair of spectacles as claimed in any one of claims 21 to 26.
31. Audio apparatus or a pair of spectacles substantially as hereinbefore described with reference to the accompanying drawings.

1/9

Fig.1.

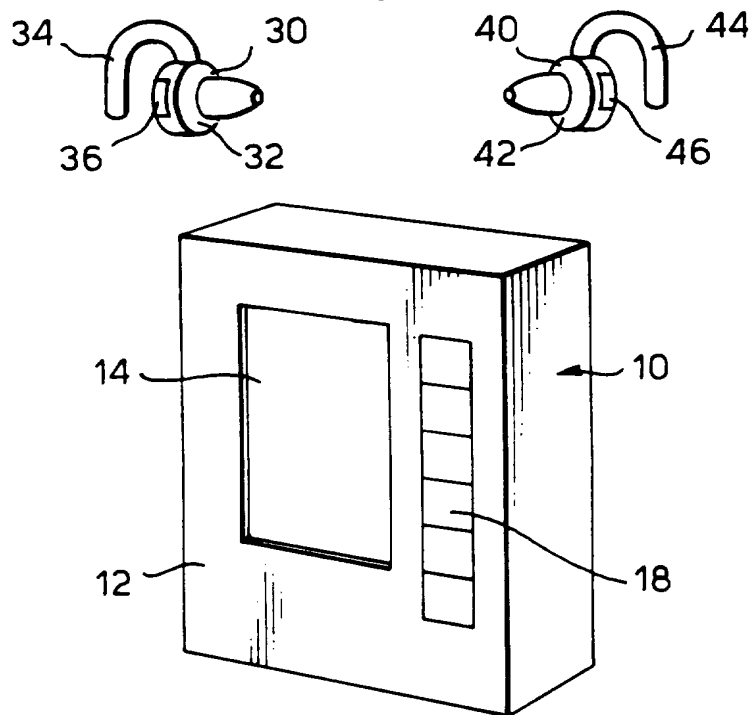
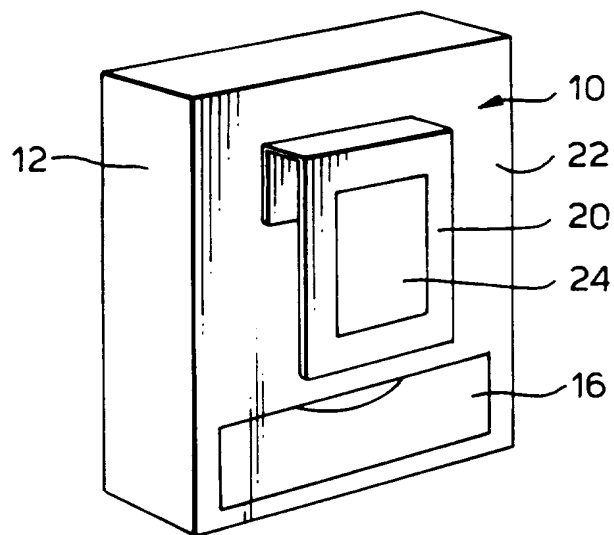


Fig.2.



2/9

Fig.3.

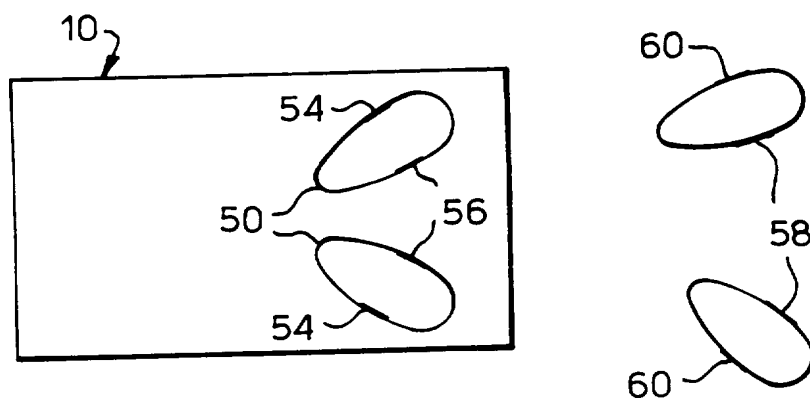
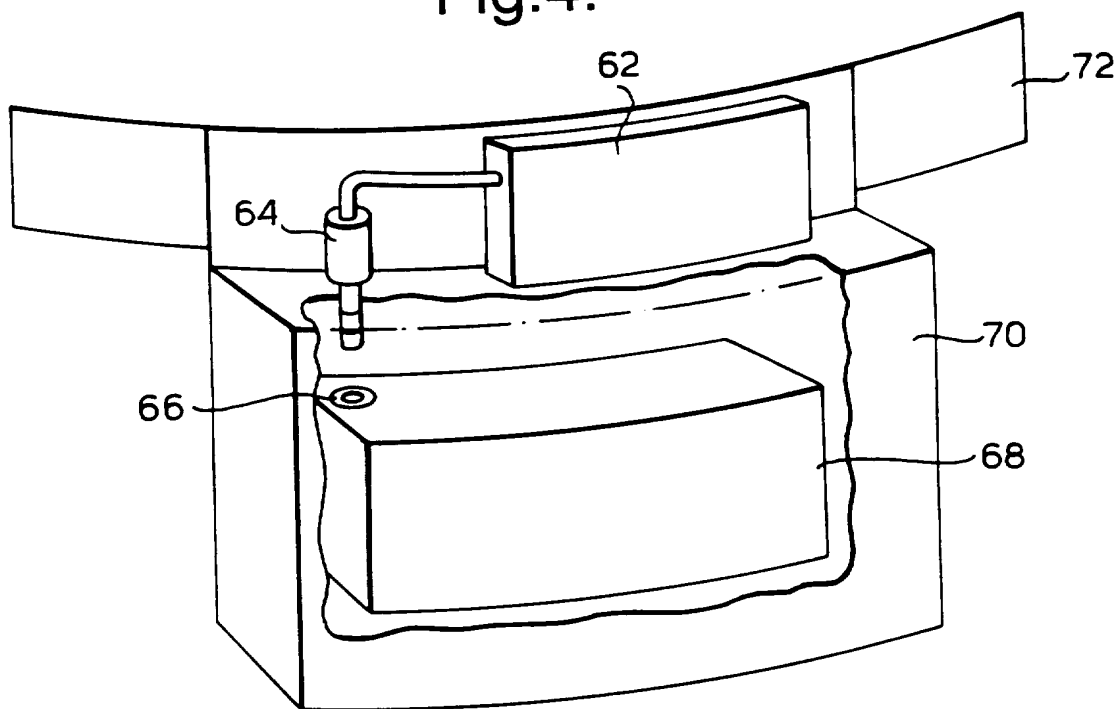


Fig.4.



3/9

Fig.5.

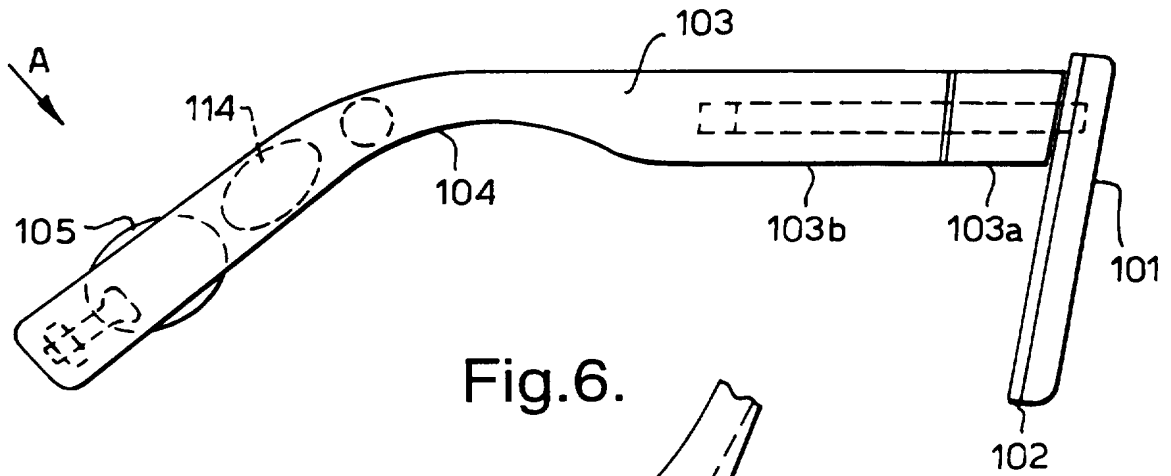


Fig.6.

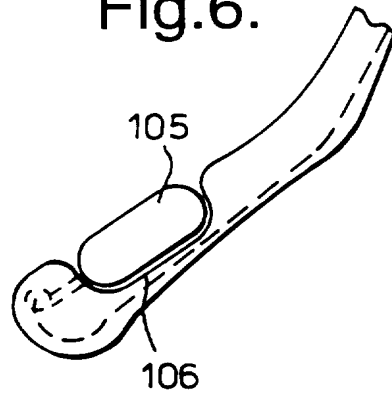
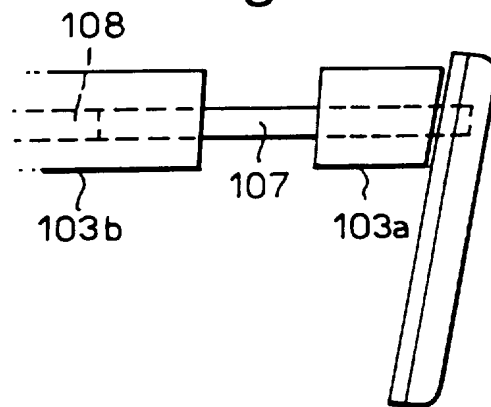


Fig.7.



4/9

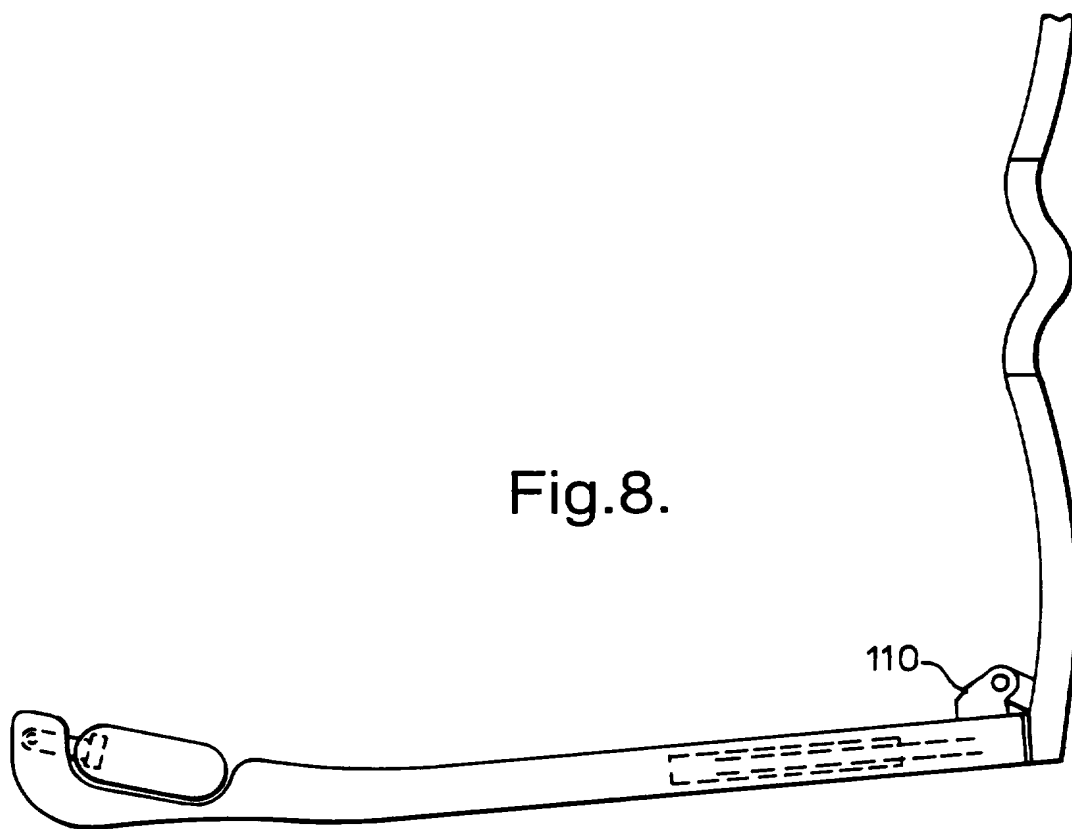
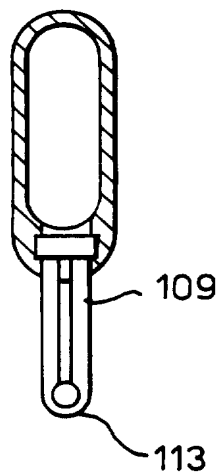


Fig. 9.



5 / 9

Fig.10.

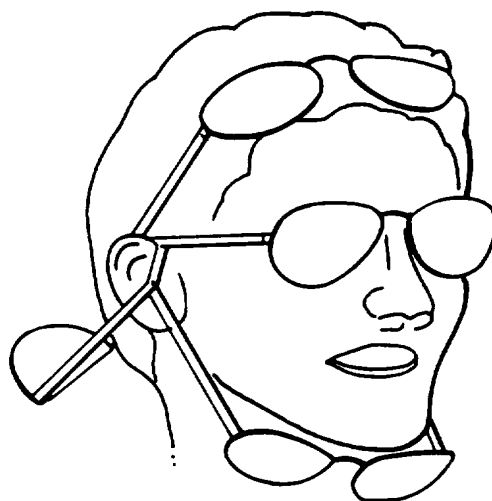


Fig.11.

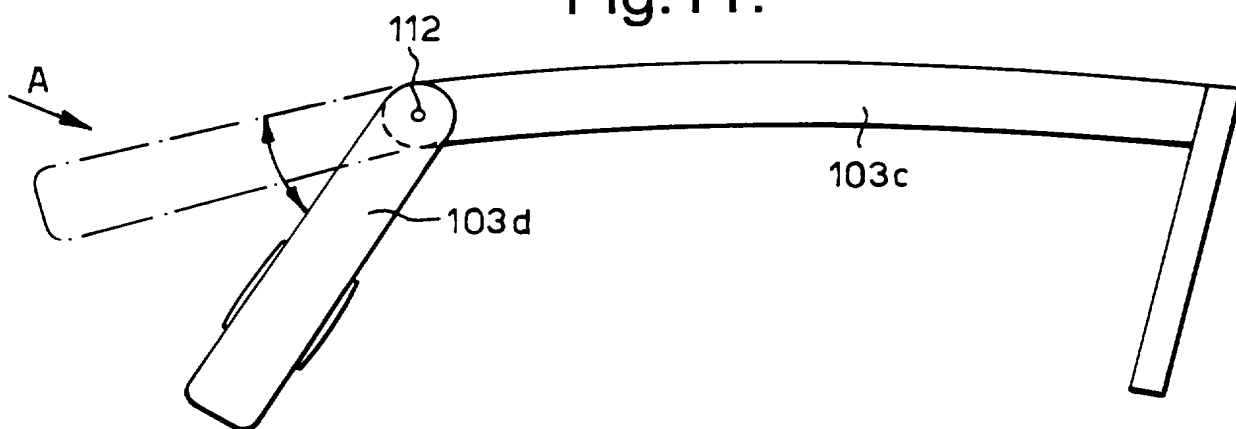


Fig.12.

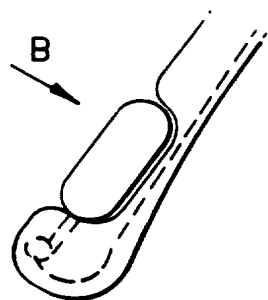
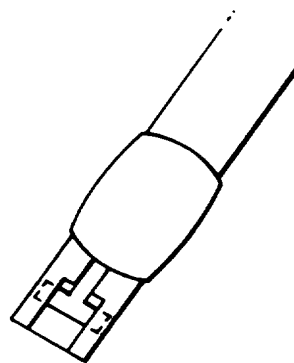


Fig.13.



6/9

Fig.14.

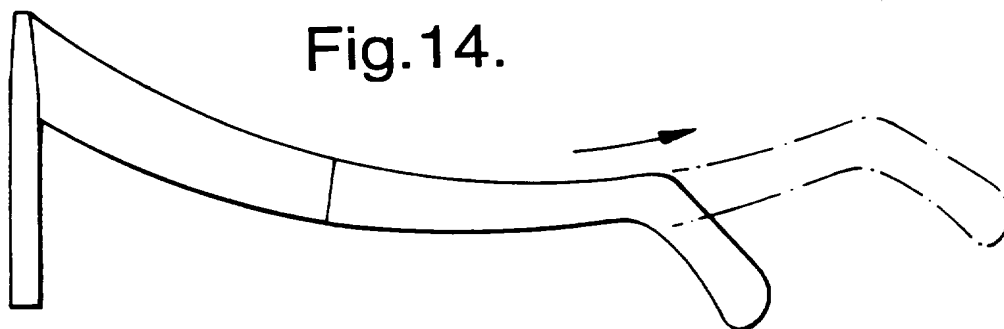


Fig.15.

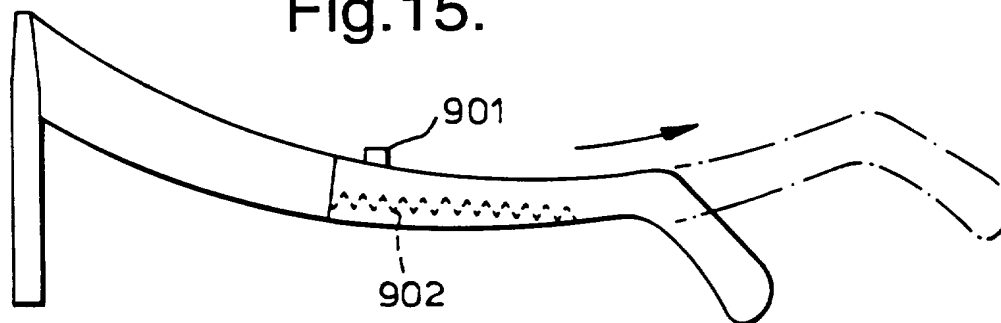
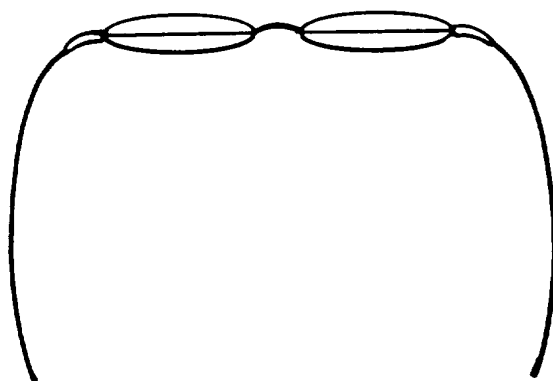


Fig.16.



7/9

Fig.17A.

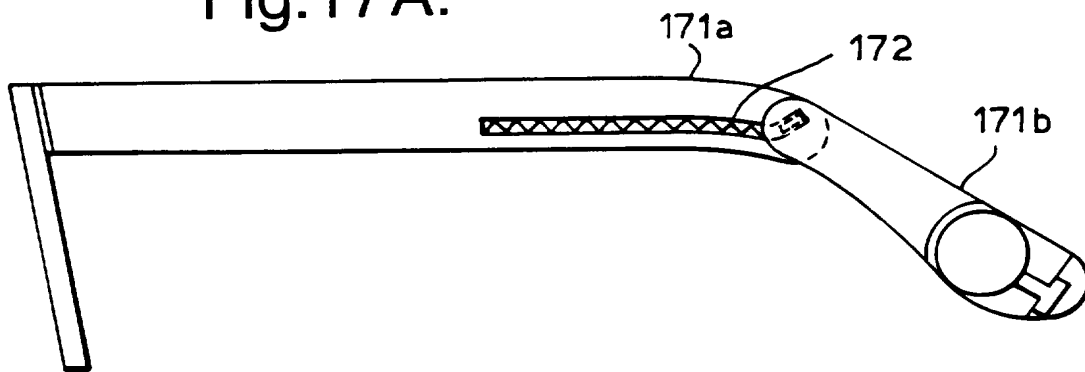


Fig.17B.

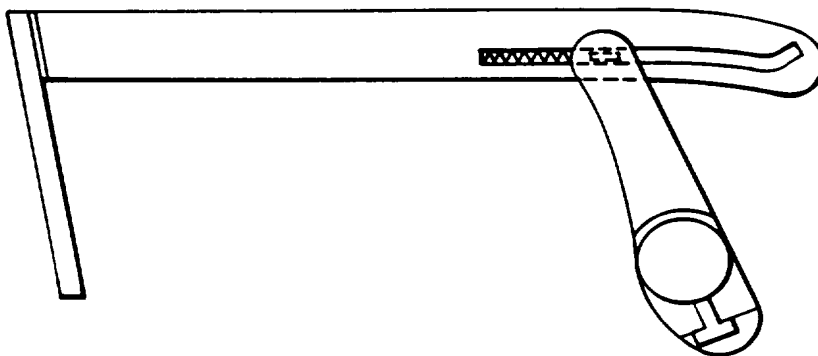
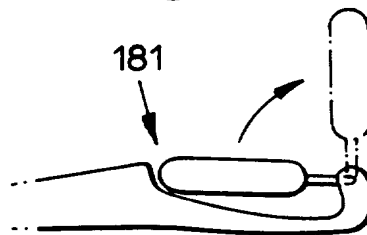


Fig.18.



8/9

Fig.19.

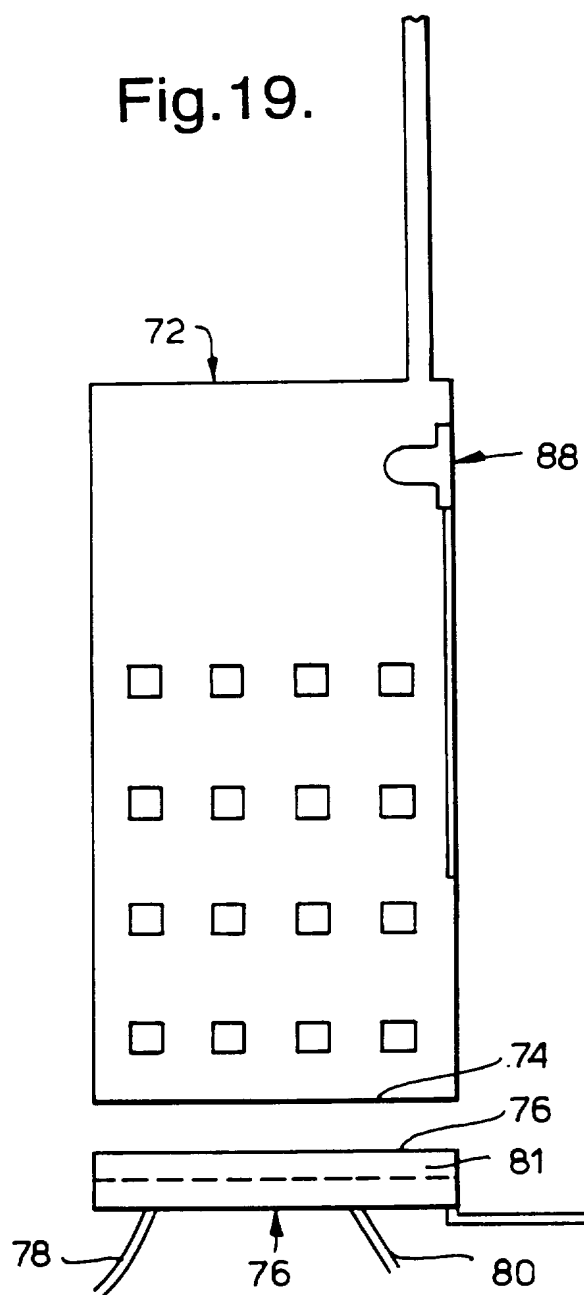
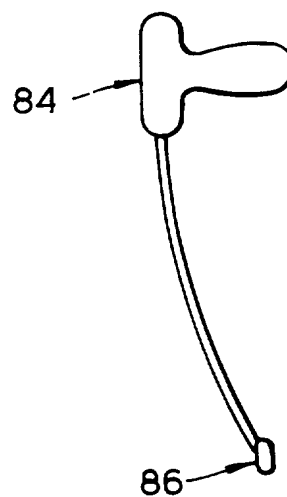


Fig.20.



82



9/9

Fig.21.

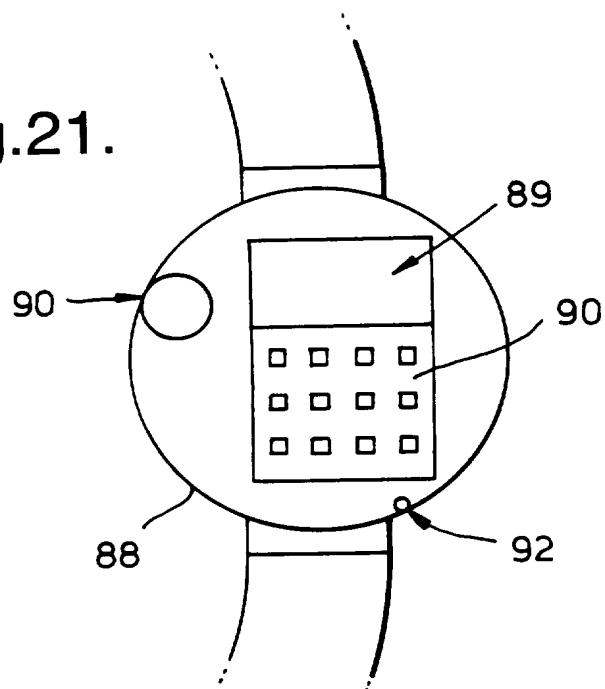
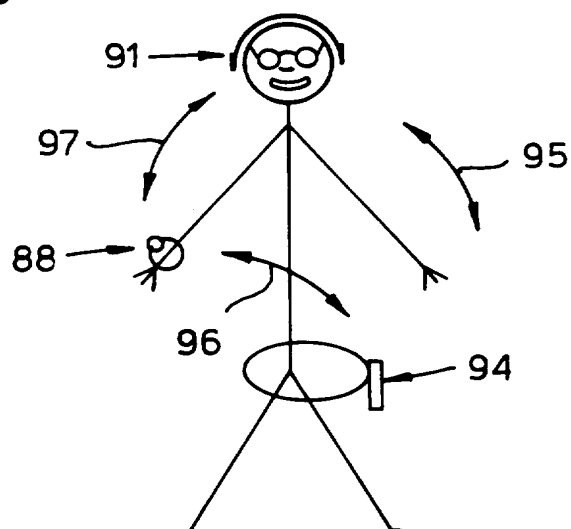


Fig.22.



INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 96/00167

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04B13/00 G08C17/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04B G08C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE,A,29 07 570 (PIETARILA ASKO OLAVI) 28 August 1980	1,2
Y	see abstract; claim 1; figure 1	4
Y	--- PATENT ABSTRACTS OF JAPAN vol. 006 no. 116 (P-125) ,29 June 1982 & JP,A,57 044276 (MATSUSHITA ELECTRIC IND CO LTD) 12 March 1982, see abstract	4
X	--- US,A,4 440 160 (FISCHELL ROBERT E ET AL) 3 April 1984 see column 4, line 47 - column 5, line 16; figure 1 see abstract	1,2
	--- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- *&* document member of the same patent family

Date of the actual completion of the international search

16 April 1996

Date of mailing of the international search report

27.06.96

Name and mailing address of the ISA

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Fax (+ 31-70) 340-3016

Authorized officer

Kolbe, W

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 96/00167

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 010 no. 117 (E-400) ,2 May 1986 & JP,A,60 250731 (MATSUSHITA DENKO KK) 11 December 1985, see abstract ---	1,2
A	EP,A,0 362 611 (FUNKE HERMANN) 11 April 1990 see abstract; claim 1; figure 2 ---	1,2
A	EP,A,0 457 492 (SONY CORP) 21 November 1991 see page 3, line 10 - line 25; figure 3 -----	4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/GB96/00167

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. claims 1-20: method and apparatus for communicating through a user's body
2. claims 21-31: a pair of spectacles with an earphone having two positions

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-20

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 96/00167

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A-2907570	28-08-80	NONE	
US-A-4440160	03-04-84	CA-A- 1199977	28-01-86
EP-A-0362611	11-04-90	DE-A- 3831809	22-03-90
		CA-A- 1316988	27-04-93
		DE-D- 68922362	01-06-95
		DE-T- 68922362	31-08-95
		US-A- 5113859	19-05-92
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		DE-D- 69117342	04-04-96
		US-A- 5247293	21-09-93